Increasing Physical Activity Among Sedentary Older Adults: What, Where, When, and With Whom

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Study Protocol and Statistical Analysis Plan

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StepMATE Study Protocol

After meeting inclusion criteria and consenting to participate in the study, all participants were administered a reduced version of the Brief Test of Adult Cognition by Telephone (BTACT) over the phone and then completed the pre-study questionnaires online via Qualtrics, including self-reported PA, social engagement, exercise control and exercise self-efficacy. Participants were then randomly assigned to one of two conditions, and researchers scheduled a phone call to help them download the app and explain the features. In the treatment condition, participants downloaded the full version of the app, with the goals, schedules, routes, and social features. Those in the control condition downloaded a version with only the daily step goals and the ability to track time, distance, and steps within a walk. Randomization was checked by comparing the covariates (age, sex, education, and general health) between conditions using independent samples *t*-tests. No significant differences were found between conditions on any of these variables.

Participants in both groups were asked to use the app for one month and do their best to answer the daily mood and energy questions. All participants were sent a pouch to wear around their waists and were encouraged to use it to carry their phone with them as much as possible until going to bed each night. After the first and third weeks, participants received an email letting them know how many weeks they had been in the study and how many remained. After the second week, researchers called participants to ask some open-ended feedback questions and ensure there were no problems with the app.

At the completion of the one-month study, participants in both groups were again administered the shortened BTACT over the phone as well as some open-ended feedback questions, and then were asked to complete the post-study questionnaires online via Qualtrics.

After completing the questionnaires, participants were sent a $25 Amazon gift card via email. After the posttest, participants in the control condition were given the opportunity to download the full version of the app, and all participants were encouraged to keep and use the app for their own personal use.

Data Analysis Plan

First, differences in app engagement between conditions was examined. Usage of the 'Walk Now' feature between conditions was compared using chi-square tests of independence and independent samples *t*-tests, and usage of the schedule and social functions were tallied, to which only the intervention condition had access.

Multilevel modeling with the LMER package in R was used to determine whether participants increased in weekly average steps over the 4-week intervention, and whether increases differed between conditions. Based on findings from the low-tech intervention study, it was predicted that the treatment group would increase their steps more than the control group.

Level 1: $\text{Step Average}_{ij} = \beta_{0j} + \beta_{1j}\,(\text{Week}) + r_{ij}$

Level 2: $\beta_{0j} = \gamma_{00} + \gamma_{01}\,(\text{Age}_j) + \gamma_{02}\,(\text{Sex}_j) + \gamma_{03}\,(\text{Condition}_j) + \gamma_{04}\,(\text{Education}_j) + \gamma_{05}\,(\text{Health}_j) + \gamma_{06}\,(\text{Condition*Week}_j) + u_{0j}$

Next, changes in the other outcome measures between pre- and post-test were examined, including self-reported vigorous, moderate, and light PA; social engagement; exercise control and self-efficacy; and memory, and whether there were differences in change from pre to post-test between conditions.

Level 1: $\text{Outcome Measure}_{ij} = \beta_{0j} + \beta_{1j}\,(\text{Time}) + r_{ij}$

Level 2: $\beta_{0j} = \gamma_{00} + \gamma_{01}\,(\text{Age}_j) + \gamma_{02}\,(\text{Sex}_j) + \gamma_{03}\,(\text{Condition}_j) + \gamma_{04}\,(\text{Education}_j) + \gamma_{05}\,(\text{Health}_j) + \gamma_{06}\,(\text{Condition*Time}_j) + u_{0j}$

Finally, within-person relationships between daily steps, mood, and energy levels were tested. Multilevel models tested whether the number of steps one took within any given day was associated with same-day mood and energy. Lagged analyses were used to determine whether steps predicted next day mood/energy, controlling for previous day mood/energy. The reverse direction from mood/energy to steps on the next day was also tested. All analyses were conducted using the LMER package in R software, controlling for age, sex, condition, education, health. To parse out between- and within-person effects, models included both weekly average and daily deviation from average as predictors. Exploratory analyses examined whether condition or sex moderated these effects.